REMARKS

Favorable reconsideration of this application, in light of the following discussion and in view of the present amendment, is respectfully requested.

Applicants are appreciative of the suggestions made by the Examiner, in the Examiner Interview of December 8, 2006, as to amendments to the claims to further clarify the invention. Applicants have endeavored to amend the claims in light of the Examiner's comments.

Claims 1-3 are amended. Claim 6 is cancelled. Claims 1-5 are pending in the application.

I. Rejection under 35 U.S.C. § 103

In the Office Action, at page 3, claims 1-6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Pub. No. 2003/0233906 to Weinhofer et al. This rejection is respectfully traversed because Weinhofer does not suggest:

> means for calculating the position of the controlled axis corresponding to time on the basis of the command movement for the controlled axis;
>
> means for calculating the position of a virtual axis moving at a fixed speed corresponding to time;
>
> means for calculating position data of the controlled axis by calculating the calculated position of the controlled axis corresponding to time as a function of the calculated position of the virtual axis moving at a fixed speed corresponding to time;
>
> means for storing the calculated position data on the calculated position of the controlled axis as a function of the calculated position of the virtual axis; and
>
> means for controlling the virtual axis and driving the controlled axis in a manner such that the controlled axis synchronously follows the virtual axis as a master axis in accordance with the position stored in said means for storing the position data of the controlled axis,

as recited in independent claim 1.

Weinhofer further does not suggest:

> means for acquiring the state of an I/O signal with respect to time obtained by an I/O signal control means using a ladder;
>
> means for calculating the position of a virtual axis moving at a fixed speed corresponding to time;
>
> means for synthesizing the acquired state of the I/O signal with respect to the calculated position of the virtual axis;

> means for storing data on the acquired state of the I/O signal obtained by said means for acquiring the state of an I/O signal with respect to the calculated position of the virtual axis calculated by said means for calculating the position of a virtual axis; and
>
> means for carrying out control of the I/O signal in accordance with the position of the virtual axis, based on the I/O signal state stored in said means for storing data on the acquired state of the I/O signal with respect to the calculated position of the virtual axis,

as recited in amended independent claim 2.

In addition, Weinhofer does not suggest:

> means for calculating the position of the controlled axis corresponding to time on the basis of the command movement for the controlled axis;
>
> means for acquiring the state of an I/O signal with respect to time obtained by an I/O signal control means using a ladder;
>
> means for calculating the position of a virtual axis moving at a fixed speed corresponding to time;
>
> means for calculating position data on the calculated position of the controlled axis with respect to the calculated position of the virtual axis and the acquired state of the I/O signal;
>
> means for storing the position data on the calculated position of the controlled axis with respect to the calculated position of the virtual axis and the acquired state of the I/O signal; and
>
> means for controlling the virtual axis and carrying out the drive of the controlled axis and control of the I/O signal in a manner such that the controlled axis synchronously follows the virtual axis as a master axis in accordance with the position and the I/O signal state stored in said means for storing the position of the controlled axis and the state of the I/O signal,

as recited in amended independent claim 3.

As a non-limiting example, the present invention as set forth in claim 1, for example, is directed to a position control device in which the position of a controlled axis is calculated corresponding to time on the basis of a command movement for the controlled axis and the position of a virtual axis moving at a fixed speed is calculated corresponding to time. Position data of the controlled axis is calculated by calculating the position of the controlled axis as a function of the calculated position of the virtual axis moving at a fixed speed. The calculated position data is stored, and the virtual axis is controlled and the controlled axis is driven such that the controlled axis synchronously follows the virtual axis as a master axis in accordance with the position stored in a means for storing the position data of the controlled axis.

Weinhofer discusses an output cam system and method in which a position of a motion control axis is monitored and an output device is controlled responsive to the position of the motion control axis. Weinhofer discusses that axis block 12 provides a control signal to the servo drive 42, which controls the speed of the motor 44, and a position of the motor 44 or of a device driven by the motor 44 is monitored. The axis block 12 is coupled to output cam blocks 14, which are coupled to output devices 50. The output cam block 14 synchronizes the operation of the output devices 50 to rotation of the shaft of the motor 44 (or to movement of a device driven by the shaft of the motor 44), such that the relationship between the axis 12 and the output block 16 is that of axis 12 representing the master and the output block 16 representing the slave.

While Weinhofer discusses that the output cam block 14 comprises control logic stored and executed in the controller module 40 that is used to control output states of the output devices 50, Weinhofer does not discuss or suggest the use of an electronic cam which operates in accordance with cam shape data. The Examiner alleges that Weinhofer teaches "monitoring a position of a motion control axis and controlling an output device responsive to the position of the motion control axis." However, in Weinhofer, the ON/OFF state of the signal controls the output device responsive to the monitored position of the motion control axis. The output device is not controlled in accordance with control of the axis.

Weinhofer states that "[t]ypically, multiple gear blocks (such as the gear block 28) and/or multiple position cam blocks (such as the position cam block 30) are coupled to receive the position information from the **virtual axis** as an input, and to provide an output to another axis block based on the position information from the virtual axis...[which] allows multiple axes to be synchronized to a common source of position reference values." Thus, while Weinhofer discusses that the output cam 14 may be controlled to the actual position of an axis and discusses that the axis block 12 may be a virtual axis where position values for the virtual axis are internally generated by the control logic, Weinhofer describes only how to move the axis, but does not suggest reproducing an operation based on stored data for actualizing a reversal operation, as discussed in the disclosure of the present application.

Weinhofer does not, therefore, suggest that the position of a controlled axis is calculated corresponding to time, based on the command movement for the controlled axis, the position of a virtual axis moving at a fixed speed is calculated corresponding to time, and that position data of the controlled axis is calculated by calculating the calculated position of the controlled axis as a function of the calculated position of the virtual axis moving at a fixed speed. Weinhofer

discusses only that the axis block 12 controls the motor 44 responsive to inputs from motion blocks 18, that the axis block 12 is coupled to output cam blocks 14 coupled to output devices 50 such that, for example, an output device 50 can be controlled responsive to axis position. However, Weinhofer does not suggest that the position of a virtual axis moving at a fixed speed is calculated as a function of time and that this calculated position is associated with the position of a controlled axis controlled in accordance with a command movement and calculated with respect to time, as recited in claim 1, for example.

Specifically, Weinhofer discusses only that output is provided to other axis blocks based on position information from a virtual axis so that the axes are synchronized to a common source of position reference values. But Weinhofer does not suggest that a controlled axis is driven to follow a virtual axis based on position data determined by calculating a position of the controlled axis as a function of a position of the virtual axis, where, based on a command movement of the controlled axis, a position of the controlled axis is calculated as a function of time and a position of the virtual axis is calculated as a function of time. Thus, Weinhofer does not suggest that the operation of either an actual or a virtual axis may be reproduced, but merely that the axes may be synchronized.

In contrast, the present invention of claim 1, for example, associates the position of a controlled axis with the position of a virtual axis, both of which were calculated with respect to time, such that a reversal operation may be reproduced, which is based on the already stored data that associates the position of the controlled axis with respect to the position of the virtual axis.

As to claim 2, Weinhofer does not suggest acquiring the state of an I/O signal with respect to time obtained by an I/O signal control means using a ladder, calculating the position of a virtual axis moving at a fixed speed corresponding to time, synthesizing the acquired state of the I/O signal with respect to the calculated position of the virtual axis, storing data on the acquired state of the I/O signal obtained by said means for acquiring the state of an I/O signal with respect to the calculated position of the virtual axis calculated by said means for calculating the position of a virtual axis, and carrying out control of the I/O signal in accordance with the position of the virtual axis, based on the I/O signal state stored in said means for storing data on the acquired state of the I/O signal with respect to the calculated position of the virtual axis. As in claim 3, Weinhofer does not further suggest calculating position data on the calculated position of the controlled axis with respect to the calculated position of the virtual axis and the acquired state of the I/O signal, controlling the virtual axis, and carrying out the drive of the

controlled axis and control of the I/O signal in a manner such that the controlled axis synchronously follows the virtual axis as a master axis in accordance with the position and the I/O signal state stored in said means for storing the position of the controlled axis and the state of the I/O signal.

Weinhofer discusses that an I/O image table may be maintained for each of the I/O devices to which it is connected and that when the output cam block 14 determines that the output device 50 should be turned on, the output cam block 14 turns on a bit in the I/O image table and the controller 40 sends a message to cause the output device 50 to turn on. Weinhofer does not, however, discuss or suggest that the state of an I/O signal is acquired and stored with respect to the calculated position of the virtual axis which is moving at a fixed speed. The I/O table of Weinhofer does not store the state of an I/O signal in association with the calculated virtual axis position at a fixed speed calculated corresponding to time.

Claim 6 is cancelled.

Therefore, as Weinhofer does not suggest the features of amended independent claims 1-3, claims 1-3 patentably distinguish over the reference relied upon. Accordingly, withdrawal of the § 103(a) rejection is respectfully requested.

Claims 4-5 depend directly or indirectly from independent claims 1-3 and include all the features of their respective independent claims, plus additional features that are not discussed or suggested by the reference relied upon. For example, claim 4 recites that "said means for carrying out control of the I/O signal includes exclusive control means for preventing the I/O signal stored in said means for storing the state of the I/O signal and an I/O signal using a ladder from being written doubly." Therefore, claims 4-5 patentably distinguish over the reference relied upon for at least the reasons noted above. Accordingly, withdrawal of the § 103(a) rejection is respectfully requested.

Conclusion

In accordance with the foregoing, claims 1-3 have been amended. Claim 6 has been cancelled. Claims 1-5 are pending and under consideration.

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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